

## Certificate of Calibration

**Calibration Certification Information**

Cal. Date: November 2, 2020      Rootsmeter S/N: 438320      Ta: 294 °K  
 Operator: Jim Tisch      Pa: 756.7 mm Hg  
 Calibration Model #: TE-5025A      Calibrator S/N: 3543

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4310	3.2	2.00
2	3	4	1	1.0110	6.4	4.00
3	5	6	1	0.9000	8.0	5.00
4	7	8	1	0.8560	8.9	5.50
5	9	10	1	0.7100	12.9	8.00

**Data Tabulation**

Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left( \frac{Pa}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left( \frac{Ta}{Pa} \right)}$ (y-axis)
1.0049	0.7022	1.4207	0.9958	0.6959	0.8815
1.0006	0.9897	2.0091	0.9915	0.9808	1.2467
0.9985	1.1094	2.2463	0.9894	1.0994	1.3938
0.9973	1.1651	2.3559	0.9882	1.1545	1.4619
0.9920	1.3971	2.8414	0.9830	1.3844	1.7631
<b>QSTD</b>	m=	2.03936	<b>QA</b>	m=	1.27701
	b=	-0.01298		b=	-0.00805
	r=	0.99995		r=	0.99995

**Calculations**

Vstd=	$\Delta Vol((Pa-\Delta P)/Pstd)(Tstd/Ta)$	Va=	$\Delta Vol((Pa-\Delta P)/Pa)$
Qstd=	Vstd/ΔTime	Qa=	Va/ΔTime
<b>For subsequent flow rate calculations:</b>			
<b>Qstd=</b> $1/m \left( \left( \sqrt{\Delta H \left( \frac{Pa}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)} \right) - b \right)$		<b>Qa=</b> $1/m \left( \left( \sqrt{\Delta H \left( \frac{Ta}{Pa} \right)} \right) - b \right)$	

**Standard Conditions**

Tstd:	298.15 °K
Pstd:	760 mm Hg
<b>Key</b>	
ΔH: calibrator manometer reading (in H2O)	
ΔP: rootsmeter manometer reading (mm Hg)	
Ta: actual absolute temperature (°K)	
Pa: actual barometric pressure (mm Hg)	
b: intercept	
m: slope	

**RECALIBRATION**

US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30



## Certificate of Calibration

**Calibration Certification Information**

<b>Cal. Date:</b> October 20, 2021	<b>Rootsmeter S/N:</b> 438320	<b>Ta:</b> 295 °K
<b>Operator:</b> Jim Tisch		<b>Pa:</b> 753.9 mm Hg
<b>Calibration Model #:</b> TE-5025A	<b>Calibrator S/N:</b> 3543	

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4300	3.2	2.00
2	3	4	1	1.0060	6.4	4.00
3	5	6	1	0.8990	7.9	5.00
4	7	8	1	0.8550	8.8	5.50
5	9	10	1	0.7050	12.8	8.00

**Data Tabulation**

Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left( \frac{Pa}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left( \frac{Ta}{Pa} \right)}$ (y-axis)
0.9978	0.6977	1.4156	0.9958	0.6963	0.8847
0.9935	0.9876	2.0020	0.9915	0.9856	1.2511
0.9915	1.1029	2.2383	0.9895	1.1007	1.3988
0.9903	1.1583	2.3476	0.9883	1.1559	1.4670
0.9850	1.3972	2.8313	0.9830	1.3944	1.7693
<b>QSTD</b>	m=	2.02434	<b>QA</b>	m=	1.26761
	b=	0.00347		b=	0.00217
	r=	1.00000		r=	1.00000

**Calculations**

<b>Vstd=</b> $\Delta Vol \left( \frac{Pa - \Delta P}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)$	<b>Va=</b> $\Delta Vol \left( \frac{Pa - \Delta P}{Pa} \right)$
<b>Qstd=</b> $Vstd / \Delta Time$	<b>Qa=</b> $Va / \Delta Time$
<b>For subsequent flow rate calculations:</b>	
<b>Qstd=</b> $1/m \left( \left( \sqrt{\Delta H \left( \frac{Pa}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)} \right) - b \right)$	<b>Qa=</b> $1/m \left( \left( \sqrt{\Delta H \left( \frac{Ta}{Pa} \right)} \right) - b \right)$

**Standard Conditions**

<b>Tstd:</b>	298.15 °K
<b>Pstd:</b>	760 mm Hg
<b>Key</b>	
ΔH: calibrator manometer reading (in H2O)	
ΔP: rootsmeter manometer reading (mm Hg)	
Ta: actual absolute temperature (°K)	
Pa: actual barometric pressure (mm Hg)	
b: intercept	
m: slope	

**RECALIBRATION**

US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30



## TE-5170 Calibration Worksheet

### Site Information

Location: AM3A      Zones 2A at West      Date: 28-Aug-21  
Site ID: Kowloon Cultural  
Sampler: TE-5170      Serial No: 4340      Tech: CS Tang

### Site Conditions

Barometric Pressure (in Hg): 29.87      Corrected Pressure (mm Hg): 759  
Temperature (deg F): 80      Temperature (deg K): 300  
Average Press. (in Hg): 29.87      Corrected Average (mm Hg): 759  
Average Temp. (deg F): 80      Average Temp. (deg K): 300

### Calibration Orifice

Make: Tisch      Qstd Slope: 2.03936  
Model: TE-5025A      Qstd Intercept: -0.01298  
Serial#: 3543      Date Certified: 2-Nov-20

### Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	12.50	1.733	53.0	52.79	Slope: 32.1441
2	10.30	1.574	48.0	47.81	Intercept: -2.4258
3	7.20	1.317	41.0	40.83	Corr. Coeff: 0.9968
4	4.70	1.065	33.0	32.87	
5	2.80	0.824	23.0	22.91	# of Observations: 5

### Calculations

$$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$$

$$IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

$$1/m((I)[\text{Sqrt}(298/Tav)(Pav/760)]-b)$$

m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure

Average I (chart): 40

Average Flow Calculation m3/min

1.302458551

Average Flow Calculation in CFM

45.98981142

Sample Time (Hrs): 1.0

Total Flow in m3/min

78.14751303

Total Flow in CFM

2759.388685

NOTE: Ensure calibration orifice has been certified within 12 months of use



## TE-5170 Calibration Worksheet

### Site Information

Location: AM3A      Zones 2A at West      Date: 26-Oct-21  
Sampler: TE-5170      Site ID: Kowloon Cultural      Tech: CS Tang  
Serial No: 4340

### Site Conditions

Barometric Pressure (in Hg): 29.99      Corrected Pressure (mm Hg): 762  
Temperature (deg F): 77      Temperature (deg K): 298  
Average Press. (in Hg): 29.99      Corrected Average (mm Hg): 762  
Average Temp. (deg F): 77      Average Temp. (deg K): 298

### Calibration Orifice

Make: Tisch      Qstd Slope: 2.02434  
Model: TE-5025A      Qstd Intercept: 0.00347  
Serial#: 3543      Date Certified: 20-Oct-21

### Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	12.60	1.753	53.0	53.05	Slope: 31.8515
2	10.50	1.601	48.0	48.05	Intercept: -2.3984
3	7.30	1.334	41.0	41.04	Corr. Coeff: 0.9957
4	4.70	1.070	33.0	33.03	
5	2.90	0.840	23.0	23.02	# of Observations: 5

### Calculations

$$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$$
$$IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

$$1/m((I) [\text{Sqrt}(298/Tav)(Pav/760)] - b)$$

m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure

Average I (chart): 40

Average Flow Calculation m3/min

1.319788485

Average Flow Calculation in CFM

46.60173141

Sample Time (Hrs): 1.0

Total Flow in m3/min

79.18730911

Total Flow in CFM

2796.103885

NOTE: Ensure calibration orifice has been certified within 12 months of use





## TE-5170 Calibration Worksheet

### Site Information

Location: AM4A      Site ID: **Zones 2A at West**      Date: 28-Aug-21  
Sampler: TE-5170      Serial No: 3998      Tech: CS Tang

### Site Conditions

Barometric Pressure (in Hg): 29.87      Corrected Pressure (mm Hg): 759  
Temperature (deg F): 80      Temperature (deg K): 300  
Average Press. (in Hg): 29.87      Corrected Average (mm Hg): 759  
Average Temp. (deg F): 80      Average Temp. (deg K): 300

### Calibration Orifice

Make: Tisch      Qstd Slope: 2.03936  
Model: TE-5025A      Qstd Intercept: -0.01298  
Serial#: 3543      Date Certified: 2-Nov-20

### Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	12.60	1.740	53.0	52.79	Slope: 30.5068
2	10.60	1.596	48.0	47.81	Intercept: -0.2636
3	7.40	1.335	41.0	40.83	Corr. Coeff: 0.9970
4	4.50	1.042	33.0	32.87	
5	2.60	0.794	23.0	22.91	# of Observations: 5

### Calculations

$$Qstd = 1/m[\text{Sqrt}(H_2O(P_a/P_{std})(T_{std}/T_a))-b]$$
$$IC = I[\text{Sqrt}(P_a/P_{std})(T_{std}/T_a)]$$

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

$$1/m((I) [\text{Sqrt}(298/T_a)(P_a/760)]-b)$$

m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure

Average I (chart): 40

Average Flow Calculation m3/min

1.301485004

Average Flow Calculation in CFM

45.9554355

Sample Time (Hrs): 1.0

Total Flow in m3/min

78.08910026

Total Flow in CFM

2757.32613

NOTE: Ensure calibration orifice has been certified within 12 months of use



## TE-5170 Calibration Worksheet

### Site Information

Location: AM4A      Site ID: **Zones 2A at West**      Date: 26-Oct-21  
Sampler: TE-5170      Serial No: 3998      Tech: CS Tang

### Site Conditions

Barometric Pressure (in Hg): 29.99      Corrected Pressure (mm Hg): 762  
Temperature (deg F): 77      Temperature (deg K): 298  
Average Press. (in Hg): 29.99      Corrected Average (mm Hg): 762  
Average Temp. (deg F): 77      Average Temp. (deg K): 298

### Calibration Orifice

Make: Tisch      Qstd Slope: 2.02434  
Model: TE-5025A      Qstd Intercept: 0.00347  
Serial#: 3543      Date Certified: 2-Nov-20

### Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	12.50	1.747	53.0	53.05	Slope: 31.9605
2	10.40	1.593	48.0	48.05	Intercept: -2.4277
3	7.30	1.334	41.0	41.04	Corr. Coeff: 0.9977
4	4.80	1.082	33.0	33.03	
5	2.80	0.826	23.0	23.02	# of Observations: 5

### Calculations

$$Qstd = 1/m[\text{Sqrt}(H_2O(P_a/P_{std})(T_{std}/T_a))-b]$$
$$IC = I[\text{Sqrt}(P_a/P_{std})(T_{std}/T_a)]$$

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

$$1/m((I) [\text{Sqrt}(298/T_a)(P_a/760)]-b)$$

m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure

Average I (chart): 4.0

Average Flow Calculation m3/min

1.316202779

Average Flow Calculation in CFM

46.47512013

Sample Time (Hrs): 1.0

Total Flow in m3/min

78.97216674

Total Flow in CFM

2788.507208

NOTE: Ensure calibration orifice has been certified within 12 months of use



## TE-5170 Calibration Worksheet

### Site Information

Location: AM5A      Zones 2A at West      Date: 28-Aug-21  
Site ID: Kowloon Cultural      Tech: CS Tang  
Sampler: TE-5170      Serial No: 4344

### Site Conditions

Barometric Pressure (in Hg): 29.87      Corrected Pressure (mm Hg): 759  
Temperature (deg F): 80      Temperature (deg K): 300  
Average Press. (in Hg): 29.87      Corrected Average (mm Hg): 759  
Average Temp. (deg F): 80      Average Temp. (deg K): 300

### Calibration Orifice

Make: Tisch      Qstd Slope: 2.03936  
Model: TE-5025A      Qstd Intercept: -0.01298  
Serial#: 3543      Date Certified: 2-Nov-20

### Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	12.40	1.726	53.0	52.79	Slope: 30.6738
2	10.20	1.566	48.0	47.81	Intercept: -0.1550
3	7.60	1.353	41.0	40.83	Corr. Coeff: 0.9974
4	4.40	1.031	33.0	32.87	
5	2.50	0.779	23.0	22.91	# of Observations: 5

### Calculations

$$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$$
$$IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

$$1/m((I)[\text{Sqrt}(298/Tav)(Pav/760)]-b)$$

m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure

Average I (chart): 40

Average Flow Calculation m3/min

1.290857523

Average Flow Calculation in CFM

45.58017915

Sample Time (Hrs): 1.0

Total Flow in m3/min

77.45145141

Total Flow in CFM

2734.810749

NOTE: Ensure calibration orifice has been certified within 12 months of use



## TE-5170 Calibration Worksheet

### Site Information

Location: AM5A      Zones 2A at West      Date: 26-Oct-21  
Site ID: Kowloon Cultural      Tech: CS Tang  
Sampler: TE-5170      Serial No: 4344

### Site Conditions

Barometric Pressure (in Hg): 29.99      Corrected Pressure (mm Hg): 762  
Temperature (deg F): 77      Temperature (deg K): 298  
Average Press. (in Hg): 29.99      Corrected Average (mm Hg): 762  
Average Temp. (deg F): 77      Average Temp. (deg K): 298

### Calibration Orifice

Make: Tisch      Qstd Slope: 2.02434  
Model: TE-5025A      Qstd Intercept: 0.00347  
Serial#: 3543      Date Certified: 2-11-2020

### Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	12.40	1.740	53.0	53.05	Slope: 30.6557
2	10.50	1.601	48.0	48.05	Intercept: -0.3652
3	7.30	1.334	41.0	41.04	Corr. Coeff: 0.9989
4	4.70	1.070	33.0	33.03	
5	2.50	0.780	23.0	23.02	# of Observations: 5

### Calculations

$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$   
 $IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

$1/m((I)[\text{Sqrt}(298/Tav)(Pav/760)]-b)$

m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure

Average I (chart): 40

Average Flow Calculation m3/min

1.304945979

Average Flow Calculation in CFM

46.0776425

Sample Time (Hrs): 1.0

Total Flow in m3/min

78.29675871

Total Flow in CFM

2764.65855

NOTE: Ensure calibration orifice has been certified within 12 months of use



INTERNATIONAL  
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# CERTIFICATE OF ACCREDITATION

*This is to attest that*

## **AQUALITY TESTCONSULT LIMITED**

11A&B, KAI FONG GARDEN, PING CHE ROAD  
FANLING, HONG KONG

### **Calibration Laboratory CL-207**

has met the requirements of AC204, *IAS Accreditation Criteria for Calibration Laboratories*, and has demonstrated compliance with ISO/IEC Standard 17025:2017, *General requirements for the competence of testing and calibration laboratories*. This organization is accredited to provide the services specified in the scope of accreditation.

Effective Date October 19, 2020

Expiration Date December 1, 2021



A handwritten signature in black ink, reading 'Raj Nathan'.

**President**

# SCOPE OF ACCREDITATION

International Accreditation Service, Inc.

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## AQUALITY TESTCONSULT LIMITED

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**Accredited to** ISO/IEC 17025:2017

**Effective Date** October 19, 2020

### CALIBRATION AND MEASUREMENT CAPABILITY (CMC)\*

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY <sup>1,2</sup> (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
<b>Dimensional</b>			
Caliper -Vernier, Dial & Electronic <sup>3</sup>	0 mm to 300 mm	30 µm	Checker by comparison method (BS 887:1982)
Steel Ruler <sup>3</sup>	1 mm to 1000 mm	280 µm	Reference Steel Rule by comparison method (BS 4372:1968)
Dial Indicator / Gauge (Plunger) <sup>3</sup>	0 mm to 50 mm	8 µm	Reference micrometer head by comparison method (BS 907:2008)
Feeler Gauge <sup>3</sup>	0.01 mm to 1 mm	8 µm	Reference Dial Gauge by comparison method (BS BS957-2008)
Measuring tape <sup>3</sup>	0 m to 1.5 m	1200 µm	Reference steel ruler by comparison method (BS 4035:1966)
Engineering Square <sup>3</sup>	Length 0 mm to 160 mm	20 µm	Reference engineering square and Feeler Gauge (BS 939:2007)
Slump cone <sup>3</sup>	Diameter = 0 mm to 200 mm Thickness = 1.5 mm Height = 0 mm to 300 mm	560 µm 100 µm 560 µm	Reference Caliper & Reference Steel ruler by direct measurement (Verification in accordance with in-house method for the dimensional requirements as specified CS1:1990 Vol.1 A4; CS1: 2010 Vol. 1, A5)
Tamping rod <sup>3</sup>	Diameter = 0 mm to 16 mm Length = 600 mm	600 µm 950 µm	Reference steel ruler & Reference Caliper by direct measurement (Verification in accordance with in-house method for the dimensional

\* If information in this CMC is presented in non-SI units, the conversion factors stated in NIST Special Publication 811 "Guide for the Use of the International System of Units (SI)" apply.



# SCOPE OF ACCREDITATION

International Accreditation Service, Inc.

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MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY <sup>1,2</sup> (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
			requirements as specified CS1:1990 Vol.1 A5;CS1: 2010 Vol. 1, A6)
Cube mould <sup>3</sup>	(Max dimensions 150 mm per side) Dimension Flatness Perpendicularity Parallelism	50 µm 10 µm 10 µm 50 µm	Reference Caliper, straight edge & feeler gauge by direct measurement. (Verification in accordance with in-house method for the dimensional requirements as specified in BS1881: Part 108:1983; CS1:1990 Vol1, A21; CS1:2010 Vol 1, A25; BS EN 12390-2:2000)
Compacting Bar <sup>3</sup>	Ramming Face = 25 mm Length = 380 mm Weight = 1.8 kg	100 µm 560 µm 1 g	Reference Caliper & Steel ruler by direct measurement. (Verification in accordance with in-house method for the dimensional & mass requirements as specified in BS1881: Part 105:1984 Cl 3.3; CS1:1990 Vol 2, E3 CS1:2010 Vol 1, A15.3; BS EN 12350 -5:2000 Cl 4.3.)
Covermeter	20 mm to 103 mm	2.9 mm	Reference concrete block (Verification in accordance with in-house method for the dimensional requirements as specified in BS 1881:Part 204:1988 Cl.6.4- Method C)
Flow table <sup>3</sup>	15 kg to 17 kg 1 mm to 71 mm	12 g 600 µm	Weighing Balance, Reference caliper & Reference steel ruler by direct measurement
Test Sieve <sup>3</sup>	4 mm to 50 mm	50 µm	Reference Caliper by direct measurement
<b>Mechanical</b>			
Force Measuring Machine <sup>3</sup> (Compression Mode)	1 kN to 3000 kN	0.4 %	Ref. Load cell by direct measurement BS 1610: Part 1:1985; BS 1610: Part 1:1992; BS EN ISO 12390-4:2000 Annex B; BS EN ISO 7500-1:2004
Laser Dust Meter <sup>3</sup>	Dust particles 0.001 mg/m <sup>3</sup> to 10.00 mg/m <sup>3</sup>	0.9 mg/m <sup>3</sup>	By comparison method by using reference laser dust meter

# SCOPE OF ACCREDITATION

International Accreditation Service, Inc.

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MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY <sup>1,2</sup> (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
Rebound Hammer <sup>3</sup>	80 unit (hardness)	1.6 rebound count	Reference Rebound count by comparison method. BS1881: Part 202:1986; BS EN 12504-2:2001; BS EN 12504-2:2012
Mass (F2 class and coarser)	1 g to 200 g 200 g to 5 kg 5 kg to 10 kg 10 kg to 50 kg	1.3 mg 0.5 g 1 g 7 g	Standard Weight E2/ F1 Class & Weighing Balances by comparison method (OIMLR111)
Weighing Scale & Balance <sup>3</sup>	1 g to 200 g 200 g to 5 kg 5 kg to 50 kg	1 mg 1 g 15 g	Standard weight of E2/F1 Grade by direct measurement
Volumetric Glassware	1 mL to 100 mL 100 mL to 1000 mL	0.004 mL 0.09 mL	Standard weight E2 Class, Weighing Balances & Distilled water by gravimetric method
<b>Thermal</b>			
Digital/Liquid in Glass Thermometers & RTD/ Thermocouples with or without Indicators	15 °C to 55°C 55°C to 95°C	0.4 °C 0.9 °C	Water Baths, Reference Sensor and Indicator by Comparison Method (OIML R133)
Curing Tank <sup>3</sup>	(Calibration at 20 °C & 27 °C @ 30 min) 20 °C Temperature distribution 27 °C Temperature distribution Efficiency of circulation	0.4 °C 0.8 °C 5 s	Reference Temperature datalogger by Mapping Method & Reference Stop Watch (Verification in accordance with in-house method for the Temp & Time requirements as specified in BS1881-111:1983 CS1:1990 Vol 1 App A24 CS1:2010 Vol 1 App A28 BE EN 12390-2:2000
Oven <sup>3</sup>	40.0 °C to 180.0 °C	1.5 °C	Reference Temperature datalogger by Mapping Method (AS 2853:1986)
Furnace <sup>3</sup>	200 °C to 1300 °C	6 °C	Reference Thermocouple with Indicator By single point Calibration (AS 2853:1986)
Water bath <sup>3</sup>	15 °C to 95 °C	0.2 °C	Reference Temperature datalogger by Mapping Method (AS 2853:1986)
<b>Time and Frequency</b>			
Stop Watch/ Timer <sup>3</sup>	10 s to 3600 s	0.2 s	Reference stop watch



# SCOPE OF ACCREDITATION

International Accreditation Service, Inc.

3060 Saturn Street, Suite 100, Brea, California 92821, U.S.A. | [www.iasonline.org](http://www.iasonline.org)

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY <sup>1,2</sup> (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
Grout Flow Cone <sup>3</sup>	7 s to 9 s	0.2 s	Reference stop watch by direct method (ASTM C939-10 Cl.9)

<sup>1</sup>The uncertainty covered by the Calibration and Measurement Capability (CMC) is expressed as the expanded uncertainty having a coverage probability of approximately 95 %. It is the smallest measurement uncertainty that a laboratory can achieve within its scope of accreditation when performing calibrations of a best existing device. The measurement uncertainty reported on a calibration certificate may be greater than that provided in the CMC due to the behavior of the calibration item and other factors that may contribute to the uncertainty of a specific calibration.

<sup>2</sup>When uncertainty is stated in relative terms (such as percent, a multiplier expressed as a decimal fraction or in scientific notation), it is in relation to instrument reading or instrument output, as appropriate, unless otherwise indicated.

<sup>3</sup>Also available as site calibration. Note that actual measurement uncertainties achievable at a customer's site can normally be expected to be larger than the uncertainties listed on this Scope of Accreditation.

# FAQ / Information

## Mutual Recognition Arrangements (MRA) / Multilateral Recognition Arrangements (MLA)

### Mutual Recognition Arrangement (MRA) Partners for HOKLAS ^

Every effort is made to promote acceptance of test data from accredited laboratories, both internationally and locally. HKAS has concluded mutual recognition arrangements with accreditation bodies listed below by being one of the signatories of the [International Laboratory Accreditation Cooperation Mutual Recognition Arrangement \(ILAC MRA\)](#) and the [Asia Pacific Accreditation Cooperation Mutual Recognition Arrangement \(APAC MRA\)](#) for testing, calibration, medical testing, Proficiency Testing Providers (PTP) and Reference Material Producers (RMP). Click [here](#) to view the up-to-date signatories of ILAC and [here](#) to access the up-to-date signatories of APAC.

Visitors checking the names, logos and accreditation symbols shown on an endorsed certificate or report should note that some of our MRA partners may have their names, logos or accreditation symbols changed recently and test reports or certificates endorsed by displaying their old accreditation symbols may still be valid during the change-over period. For details, please visit their websites or contact them directly.

» [Mutual Recognition Arrangement \(MRA\) Partners for HOKLAS](#)

HKAS MRA partners will recognise HOKLAS endorsed test certificates as having the same technical validity as certificates endorsed by their respective schemes.

### Multilateral Recognition Arrangements (MLA) for HKCAS ^

HKAS has been a signatory of [Asia Pacific Accreditation Cooperation Mutual Recognition Arrangement \(APAC MRA\)](#) for Quality Management System (QMS), Environmental Management System (EMS), Food Safety Management System (FSMS), Energy Management System (EnMS), Occupational Health and Safety Management System (OHSMS) certifications, product certifications, and Greenhouse Gas (GHG) validation and verification.

HKAS has also been a signatory of the [International Accreditation Forum Multilateral Recognition Arrangement \(IAF MLA\)](#) for Quality Management System (QMS), Environmental Management System (EMS), Food Safety Management System (FSMS), Energy Management System (EnMS), Occupational Health and Safety Management System (OHSMS) certifications, product certifications, and Greenhouse Gas (GHG) validation and verification.

Click [here](#) to view the up-to-date signatories of IAF and [here](#) to access the up-to-date signatories of APAC.


» [Mutual / Multilateral Recognition Arrangements \(MRA / MLA\) Partners for HKCAS](#)

### Mutual Recognition Arrangement (MRA) Partners for HKIAS ^

HKAS has concluded mutual recognition arrangements with accreditation bodies listed below by being one of the signatories of the [International Laboratory Accreditation Cooperation Mutual Recognition Arrangement \(ILAC MRA\)](#) and [Asia Pacific Accreditation Cooperation Mutual Recognition Arrangement \(APAC MRA\)](#) for inspection. Click [here](#) to view the up-to-date signatories of ILAC and [here](#) to access the up-to-date signatories of APAC.

HKAS MRA partners will recognise HKIAS endorsed inspection reports or certificates having the same technical validity as reports or certificates endorsed by their respective schemes.

» [Mutual Recognition Arrangement \(MRA\) Partners for HKIAS](#)

 back

## Hong Kong Laboratory Accreditation Scheme (HOKLAS) - Mutual Recognition Arrangement (MRA) Partners

Economy	Logo	Name of Partner	URL	Test Area
United Kingdom of Great Britain and Northern Ireland		United Kingdom Accreditation Service (UKAS)	<a href="http://www.ukas.com">http://www.ukas.com</a>	Calibration, Medical Testing, Proficiency Testing Provider, Reference Material Producer, Non-medical Testing
United States of America		AIHA Laboratory Accreditation Programs, LLC (AIHA-LAP, LLC)	<a href="http://www.aihaaccreditedlabs.org/">http://www.aihaaccreditedlabs.org/</a>	Non-medical Testing
United States of America		American Association for Laboratory Accreditation (A2LA)	<a href="http://www.a2la.org/">http://www.a2la.org/</a>	Calibration, Medical Testing, Proficiency Testing Provider, Reference Material Producer, Non-medical Testing
United States of America		ANSI-ASQ National Accreditation Board (ANAB)	<a href="https://www.ansi.org/accreditation/Default">https://www.ansi.org/accreditation/Default</a>	Calibration, Medical Testing, Proficiency Testing Provider, Reference Material Producer, Non-medical Testing
United States of America		International Accreditation Service Inc. (IAS)	<a href="http://www.iasonline.org/">http://www.iasonline.org/</a>	Calibration, Non-medical Testing
United States of America		National Voluntary Laboratory Accreditation Program (NVLAP)	<a href="http://www.nist.gov/nvlap">http://www.nist.gov/nvlap</a>	Calibration, Non-medical Testing



東恒測試顧問有限公司

AQUALITY TESTCONSULT LIMITED

香港新界粉嶺坪輦路啟芳園11A&11B號

No. 11A&B, KAI FONG GARDEN, PING CHE ROAD, FANLING, NEW TERRITORIES, HONG KONG

TEL : 852-3582-9589 FAX : 852-2674-1177 EMAIL : cal.aqtl@gmail.com WEBSITE: www.aqtlgroup.com

### CERTIFICATE OF CALIBRATION

Report Number : 201108MCA-126F  
Date of Report : 12-Nov-20  
Page Number : 1 of 2  
Customer \* : Apex Testing & Certification Ltd.  
Customer Address\* : Unit D6A, 10/F, TML Tower, 3 Hoi Shing Road, Tsuen Wan, N.T., HK  
Customers Ref. \* : A005

#### Item Under Calibration (IUC)\*

Equipment No. : N/A  
Manufacturer : Sibata Scientific Technology Ltd  
Model No. : LD-3B  
Serial No. : 235811  
Scale Division : 0.001 mg/m<sup>3</sup>  
Range : 0.001 to 1 mg/m<sup>3</sup>  
Condition of Item : Normal

Date Item Received : 8-Nov-20  
Date Calibrated : 8-Nov-20  
Calibration Location : AQuality Calibration Lab.  
Date of Next Calibration : 7-Nov-21  
Calibrated By : Jessica Liu

#### Test Environment

Ambient Temperature : 27.5 °C to 23.9 °C  
Relative Humidity : 51 % to 83 %

### Calibration Results

Reference True Reading (mg/m <sup>3</sup> )	Average IUC Reading (mg/m <sup>3</sup> )	Correction (mg/m <sup>3</sup> )	Error of IUC Reading (%)	Expanded Uncertainty (mg/m <sup>3</sup> )	Coverage Factor K
0.158	0.167	-0.008	5.1%	0.020	2.0
5.164	5.647	-0.484	8.5%	0.463	2.0
10.100	11.141	-1.041	9.3%	0.904	2.0

#### Remarks :

- \* Denotes information supplied by customer.
- The results relate only to the items calibrated.
- The results apply to the items as received.
- Correction = Average of (Ref reading - IUC reading)
- The technical requirement of laser dust meter. +/- 20% error for the particles concentration.

Approved by:

LEE Mei Yee, Julia  
Managing Director



東恒測試顧問有限公司

AQUALITY TESTCONSULT LIMITED

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### **CERTIFICATE OF CALIBRATION**

Report Number : 201108MCA-126F  
Date of Report : 12-Nov-20  
Page Number : 2 of 2  
Customer \* : Apex Testing & Certification Ltd.  
Customers Ref. \* : A005

#### **Details of Calibration**

1. The calibration was performed in accordance with AQuality Testconsult Procedure Number ENV-L-003 (in-house method), by comparison with the laboratory's reference equipment which have traceable international standards of measurement.
2. The item under calibration (IUC) was allowed to stabilize in the laboratory for 0.25 hour before commencement of calibration.
3. A set of readings were made at each calibration concentration. The values quoted in the results are the average of each set of readings.
4. The values given in this calibration certificate only relate to the values measured at the time of calibration. Any uncertainties quoted do not include allowance for the capability of any other laboratory to repeat the measurement. The uncertainty quoted relate only to item at time of calibration. AQuality Testconsult Limited is not liable for any loss or damage resulting from the use of this equipment.
5. The identification, calibration certificate numbers for the reference equipment used were as follows :

<u>Equipment Number</u>	<u>Certificate Number</u>	<u>Description</u>
CH-LDM-1	HBW202001563	粉尘测试仪

6. Copies of the Calibration certificates of the reference equipment used in this calibration may be obtained from AQuality Testconsult Limited, if necessary.

- End of Report -





東恒測試顧問有限公司

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FAX : 852-2674-1177

EMAIL : cal.aqtl@gmail.com

WEBSITE: www.aqtlgroup.com

### CERTIFICATE OF CALIBRATION

Apex Testing & Certification Ltd. Unit D6A, 10/F, TML Tower, 3 Hoi Shing Road, Tsuen Wan, N.T., HK	Test Report No.	201108MCA-126F
	Date of Issue	12-Nov-20
	Date of Testing	8-Nov-20
	Page	1 of 1

#### Item for Calibration

Description	: Laser Dust Monitor
Manufacturer	: Sibata Scientific Technology Ltd
Model No.	: LD-3B
Serial No.	: 235811

#### Standard Equipment

Description	: High Volume Sampler / Calibration Orifice
Manufacturer	: Tisch Environmental, Inc.
Model No.	: TE-5170 / TE-5025A
Serial No.	: 4344 / 3543
Last Calibration	: 8-Nov-20 / 2-Nov-20

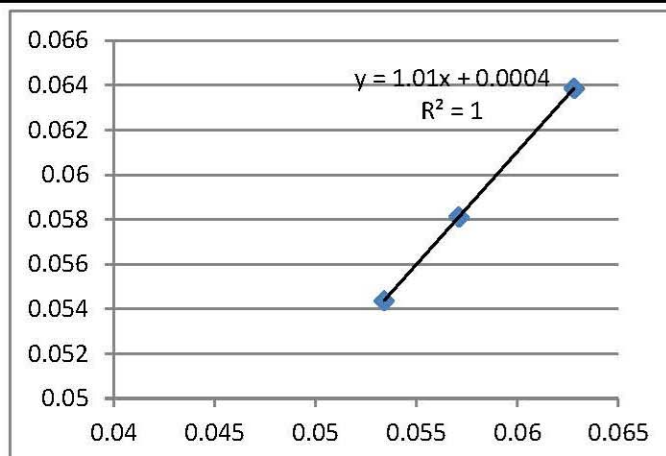
Date	Time	Mean Temp (°C)	Mean Pressure (hPa)	Concentration Standard Equipment (mg/m3)	Concentration Calibrated Equipment (mg/m3)
8-Nov-20	20:15	25.7	1017.2	0.0628	0.0639
8-Nov-20	21:20	25.7	1017.2	0.0534	0.0544
8-Nov-20	22:25	25.7	1017.2	0.0571	0.0581

By Linear Regression of Y or X

Slope (K-factor) : 1.0100

Correlation Coefficient : 1.0000

Validity of Calibration : 7-Nov-21



Recorded by : Jessica Liu

Signature:

Date: 8-Nov-20

Checked by : S Tang

Signature:

Date: 8-Nov-20

**東恒測試顧問有限公司****AQUALITY TESTCONSULT LIMITED**

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**CERTIFICATE OF CALIBRATION**

Report Number : 201108MCA-123F  
 Date of Report : 12-Nov-20  
 Page Number : 1 of 2  
 Customer \* : Apex Testing & Certification Ltd.  
 Customer Address\* : Unit D6A, 10/F, TML Tower, 3 Hoi Shing Road, Tsuen Wan, N.T., HK  
 Customers Ref. \* : A005

**Item Under Calibration (IUC)\***

Equipment No. : N/A  
 Manufacturer : Sibata Scientific Technology Ltd  
 Model No. : LD-3B  
 Serial No. : 336338  
 Scale Division : 0.001 mg/m<sup>3</sup>  
 Range : 0.001 to 1 mg/m<sup>3</sup>  
 Condition of Item : Normal

Date Item Received : 8-Nov-20  
 Date Calibrated : 8-Nov-20  
 Calibration Location : AQuality Calibration Lab.  
 Date of Next Calibration : 7-Nov-21  
 Calibrated By : Jessica Liu

**Test Environment**

Ambient Temperature : 27.5 °C to 23.9 °C  
 Relative Humidity : 51 % to 83 %

**Calibration Results**

Reference True Reading (mg/m <sup>3</sup> )	Average IUC Reading (mg/m <sup>3</sup> )	Correction (mg/m <sup>3</sup> )	Error of IUC Reading (%)	Expanded Uncertainty (mg/m <sup>3</sup> )	Coverage Factor K
0.158	0.168	-0.010	5.7%	0.026	2.0
5.164	5.562	-0.398	7.1%	0.462	2.0
10.100	10.936	-0.837	7.6%	0.905	2.0

**Remarks :**

- \* Denotes information supplied by customer.
- The results relate only to the items calibrated.
- The results apply to the items as received.
- Correction = Average of (Ref reading - IUC reading)
- The technical requirement of laser dust meter. +/- 20% error for the particles concentration.

Approved by: \_\_\_\_\_

LEE Mei Yee, Julia  
 Managing Director





東恒測試顧問有限公司

AQUALITY TESTCONSULT LIMITED

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### **CERTIFICATE OF CALIBRATION**

Report Number : 201108MCA-123F  
Date of Report : 12-Nov-20  
Page Number : 2 of 2  
Customer \* : Apex Testing & Certification Ltd.  
Customers Ref. \* : A005

#### **Details of Calibration**

1. The calibration was performed in accordance with AQuality Testconsult Procedure Number ENV-L-003 (in-house method), by comparison with the laboratory's reference equipment which have traceable international standards of measurement.
2. The item under calibration (IUC) was allowed to stabilize in the laboratory for 0.25 hour before commencement of calibration.
3. A set of readings were made at each calibration concentration. The values quoted in the results are the average of each set of readings.
4. The values given in this calibration certificate only relate to the values measured at the time of calibration. Any uncertainties quoted do not include allowance for the capability of any other laboratory to repeat the measurement. The uncertainty quoted relate only to item at time of calibration. AQuality Testconsult Limited is not liable for any loss or damage resulting from the use of this equipment.
5. The identification, calibration certificate numbers for the reference equipment used were as follows :

<u>Equipment Number</u>	<u>Certificate Number</u>	<u>Description</u>
CH-LDM-1	HBW202001563	粉尘测试仪

6. Copies of the Calibration certificates of the reference equipment used in this calibration may be obtained from AQuality Testconsult Limited, if necessary.

- End of Report -



東恒測試顧問有限公司

AQUALITY TESTCONSULT LIMITED

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WEBSITE: www.aqtlgroup.com

### CERTIFICATE OF CALIBRATION

Apex Testing & Certification Ltd. Unit D6A, 10/F, TML Tower, 3 Hoi Shing Road, Tsuen Wan, N.T., HK	Test Report No.	201108MCA-123F
	Date of Issue	12-Nov-20
	Date of Testing	8-Nov-20
	Page	1 of 1

#### Item for Calibration

Description	: Laser Dust Monitor
Manufacturer	: Sibata Scientific Technology Ltd
Model No.	: LD-3B
Serial No.	: 336338

#### Standard Equipment

Description	: High Volume Sampler / Calibration Orifice
Manufacturer	: Tisch Environmental, Inc.
Model No.	: TE-5170 / TE-5025A
Serial No.	: 4344 / 3543
Last Calibration	: 8-Nov-20 / 2-Nov-20

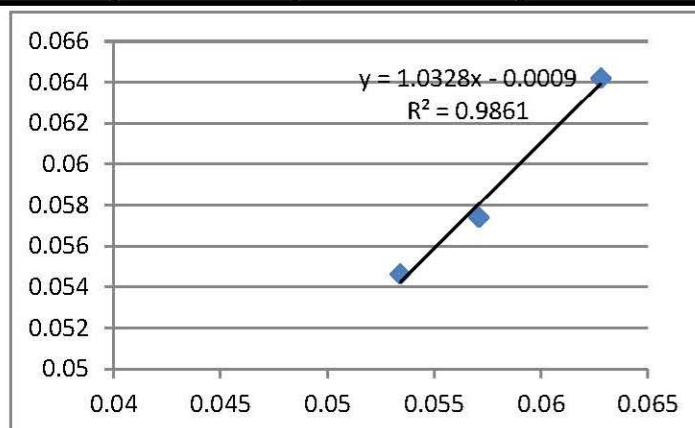
Date	Time	Mean Temp (°C)	Mean Pressure (hPa)	Concentration Standard Equipment (mg/m <sup>3</sup> )	Concentration Calibrated Equipment (mg/m <sup>3</sup> )
8-Nov-20	20:15	25.7	1017.2	0.0628	0.0642
8-Nov-20	21:20	25.7	1017.2	0.0534	0.0546
8-Nov-20	22:25	25.7	1017.2	0.0571	0.0574

By Linear Regression of Y or X

Slope (K-factor) : 1.0328

Correlation Coefficient : 0.9861

Validity of Calibration : 7-Nov-21



Recorded by : Jessica Liu Signature:  Date: 8-Nov-20

Checked by : S Tang Signature:  Date: 8-Nov-20



### CERTIFICATE OF CALIBRATION

Report Number : 201108MCA-125F  
Date of Report : 12-Nov-20  
Page Number : 1 of 2  
Customer \* : Apex Testing & Certification Ltd.  
Customer Address\* : Unit D6A, 10/F, TML Tower, 3 Hoi Shing Road, Tsuen Wan, N.T., HK  
Customers Ref. \* : A005

#### Item Under Calibration (IUC)\*

Equipment No. : N/A  
Manufacturer : Sibata Scientific Technology Ltd  
Model No. : LD-3B  
Serial No. : 567188  
Scale Division : 0.001 mg/m<sup>3</sup>  
Range : 0.001 to 1 mg/m<sup>3</sup>  
Condition of Item : Normal

Date Item Received : 8-Nov-20  
Date Calibrated : 8-Nov-20  
Calibration Location : AQuality Calibration Lab.  
Date of Next Calibration : 7-Nov-21  
Calibrated By : Jessica Liu

#### Test Environment

Ambient Temperature : 27.5 °C to 23.9 °C  
Relative Humidity : 51 % to 83 %

### Calibration Results

Reference True Reading (mg/m <sup>3</sup> )	Average IUC Reading (mg/m <sup>3</sup> )	Correction (mg/m <sup>3</sup> )	Error of IUC Reading (%)	Expanded Uncertainty (mg/m <sup>3</sup> )	Coverage Factor K
0.158	0.167	-0.008	4.9%	0.023	2.0
5.164	5.693	-0.530	9.3%	0.463	2.0
10.100	11.045	-0.945	8.6%	0.905	2.0

#### Remarks

- :  
1. \* Denotes information supplied by customer.  
2. The results relate only to the items calibrated.  
3. The results apply to the items as received.  
4. Correction = Average of (Ref reading - IUC reading)  
5. The technical requirement of laser dust meter. +/- 20% error for the particles concentration.

Approved by:

LEE Mei Yee, Julia  
Managing Director





東恒測試顧問有限公司

AQUALITY TESTCONSULT LIMITED

香港新界粉嶺坪輦路啟芳園11A&11B號

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TEL : 852-3582-9589 FAX : 852-2674-1177 EMAIL : cal.aqtl@gmail.com WEBSITE: www.aqtlgroup.com

### **CERTIFICATE OF CALIBRATION**

Report Number : 201108MCA-125F  
Date of Report : 12-Nov-20  
Page Number : 2 of 2  
Customer \* : Apex Testing & Certification Ltd.  
Customers Ref. \* : A005

#### **Details of Calibration**

1. The calibration was performed in accordance with AQuality Testconsult Procedure Number ENV-L-003 (in-house method), by comparison with the laboratory's reference equipment which have traceable international standards of measurement.
2. The item under calibration (IUC) was allowed to stabilize in the laboratory for 0.25 hour before commencement of calibration.
3. A set of readings were made at each calibration concentration. The values quoted in the results are the average of each set of readings.
4. The values given in this calibration certificate only relate to the values measured at the time of calibration. Any uncertainties quoted do not include allowance for the capability of any other laboratory to repeat the measurement. The uncertainty quoted relate only to item at time of calibration. AQuality Testconsult Limited is not liable for any loss or damage resulting from the use of this equipment.
5. The identification, calibration certificate numbers for the reference equipment used were as follows :

<u>Equipment Number</u>	<u>Certificate Number</u>	<u>Description</u>
CH-LDM-1	HBW202001563	粉尘测试仪

6. Copies of the Calibration certificates of the reference equipment used in this calibration may be obtained from AQuality Testconsult Limited, if necessary.

- End of Report -



東恒測試顧問有限公司

AQUALITY TESTCONSULT LIMITED

香港新界粉嶺坪輦路啟芳園11A&11B號

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TEL : 852-3582-9589

FAX : 852-2674-1177

EMAIL : cal.aqtl@gmail.com

WEBSITE: www.aqtlgroup.com

### CERTIFICATE OF CALIBRATION

Apex Testing & Certification Ltd.	Test Report No.	201108MCA-125F
Unit D6A, 10/F, TML Tower, 3 Hoi Shing Road, Tsuen Wan, N.T., HK	Date of Issue	12-Nov-20
	Date of Testing	8-Nov-20
	Page	1 of 1

#### Item for Calibration

Description	: Laser Dust Monitor
Manufacturer	: Sibata Scientific Technology Ltd
Model No.	: LD-3B
Serial No.	: 567188

#### Standard Equipment

Description	: High Volume Sampler / Calibration Orifice
Manufacturer	: Tisch Environmental, Inc.
Model No.	: TE-5170 / TE-5025A
Serial No.	: 4344 / 3543
Last Calibration	: 8-Nov-20 / 2-Nov-20

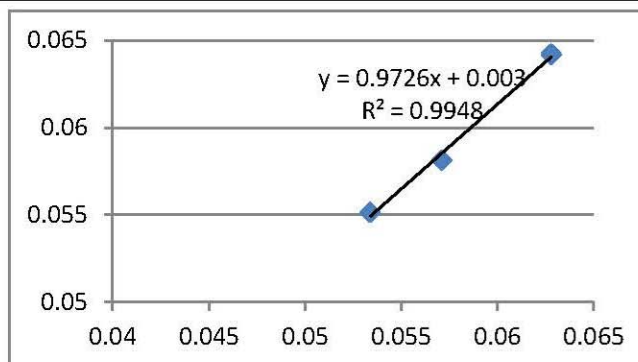
Date	Time	Mean Temp (°C)	Mean Pressure (hPa)	Concentration Standard Equipment (mg/m3)	Concentration Calibrated Equipment (mg/m3)
8-Nov-20	20:15	25.7	1017.2	0.0628	0.0642
8-Nov-20	21:20	25.7	1017.2	0.0534	0.0552
8-Nov-20	22:25	25.7	1017.2	0.0571	0.0581

By Linear Regression of Y or X

Slope (K-factor) : 0.9726

Correlation Coefficient : 0.9948

Validity of Calibration : 7-Nov-21



Recorded by : Jessica Liu

Signature:

Date: 8-Nov-20

Checked by : S Tang

Signature:

Date: 8-Nov-20



綜合試驗有限公司

SOILS & MATERIALS ENGINEERING CO., LTD.

香港新界葵涌永基路22-24號好爸爸創科大廈

Good Ba Ba Hitech Building, Nos. 22-24 Wing Kei Road, Kwai Chung, New Territories, Hong Kong

Tel: (852) 2873 6860 Fax: (852) 2555 7533 E-mail: smec@cigismec.com Website: www.cigismec.com



## CERTIFICATE OF CALIBRATION

Certificate No.: 21CA0407 01-02

Page 1 of 2

### Item tested

Description:	Sound Level Meter (Class 1)	Microphone
Manufacturer:	Hangzhou Aihua Instruments Co., Ltd	-
Type/Model No.:	AWA5661	AWA14425
Serial/Equipment No.:	304718	21038
Adaptors used:	-	-

### Item submitted by

Customer Name:	Apex Testing & Certification Ltd.
Address of Customer:	Unit D6A, 10/F, TML Tower, 3 Hoi Shing Road, Tsuen Wan, N.T.
Request No.:	-
Date of receipt:	07-Apr-2021

Date of test: 11-Apr-2021

### Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Multi function sound calibrator	B&K 4226	2288444	23-Aug-2021	CIGISMEC
Signal generator	DS 360	33873	19-May-2021	CEPREI

### Ambient conditions

Temperature:	22 ± 1 °C
Relative humidity:	55 ± 10 %
Air pressure:	1005 ± 5 hPa

### Test specifications

- 1, The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 and the lab calibration procedure SMTP004-CA-152.
- 2, The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of ±20%.
- 3, The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responsiveness of the Sound Level Meter.

### Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

Actual Measurement data are documented on worksheets.

Approved Signatory:

Feng Junqi

Date: 12-Apr-2021

Company Chop:



Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument. The results apply to the item as received.





## CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 21CA0407 01-02 Page 2 of 2

### 1, Electrical Tests

The electrical tests were performed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

Test:	Subtest:	Status:	Expanded Uncertainty (dB)	Coverage Factor
Self-generated noise	A	Pass	0.3	
	C	Pass	0.8	2.1
	Lin	Pass	1.6	2.2
Linearity range for Leq	At reference range, Step 5 dB at 4 kHz	Pass	0.3	
	Reference SPL on all other ranges	Pass	0.3	
	2 dB below upper limit of each range	Pass	0.3	
	2 dB above lower limit of each range	Pass	0.3	
Linearity range for SPL	At reference range, Step 5 dB at 4 kHz	Pass	0.3	
	A	Pass	0.3	
	C	Pass	0.3	
	Lin	Pass	0.3	
Time weightings	Single Burst Fast	Pass	0.3	
	Single Burst Slow	Pass	0.3	
Peak response	Single 100µs rectangular pulse	Pass	0.3	
R.M.S. accuracy	Crest factor of 3	Pass	0.3	
Time weighting I	Single burst 5 ms at 2000 Hz	Pass	0.3	
	Repeated at frequency of 100 Hz	Pass	0.3	
Time averaging	1 ms burst duty factor 1/10 <sup>3</sup> at 4kHz	Pass	0.3	
	1 ms burst duty factor 1/10 <sup>4</sup> at 4kHz	Pass	0.3	
Pulse range	Single burst 10 ms at 4 kHz	Pass	0.4	
Sound exposure level	Single burst 10 ms at 4 kHz	Pass	0.4	
Overload indication	SPL	Pass	0.3	
	Leq	Pass	0.4	

### 2, Acoustic tests

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

Test:	Subtest	Status	Expanded Uncertainty (dB)	Coverage Factor
Acoustic response	Weighting A at 125 Hz	Pass	0.3	
	Weighting A at 8000 Hz	Pass	0.5	

### 3, Response to associated sound calibrator

N/A

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

Calibrated by:

Date:

Fung Chi Yip  
11-Apr-2021

Checked by:

Date:

Chan Yuk Yiu  
12-Apr-2021

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.



Test Data for Sound Level Meter

Page 1 of 5

Sound level meter type: AWA5661  
Microphone type: AWA14425

Serial No. 304718  
Serial No. 21038

Date 11-Apr-2021

Report: 21CA0407 01-02

## SELF GENERATED NOISE TEST

The noise test is performed in the most sensitive range of the SLM with the microphone replaced by an equivalent impedance.

Noise level in A weighting	17.1	dB
Noise level in C weighting	18.5	dB
Noise level in Lin	21.0	dB

## LINEARITY TEST

The linearity is tested relative to the reference sound pressure level using a continuous sinusoidal signal of frequency 4 kHz. The measurement is made on the reference range for indications at 5 dB intervals starting from the 94 dB reference sound pressure level. And until within 5 dB of the upper and lower limits of the reference range, the measurements shall be made at 1 dB intervals.(SLM set to LEQ/SPL)

Reference/Expected level	Actual level		Tolerance	Deviation	
	non-integrated	integrated		non-integrated	integrated
dB	dB	dB	+/- dB	dB	dB
94.0	94.0	94.0	0.7	0.0	0.0
99.0	99.0	99.0	0.7	0.0	0.0
104.0	104.0	104.0	0.7	0.0	0.0
109.0	109.0	109.0	0.7	0.0	0.0
114.0	114.0	114.0	0.7	0.0	0.0
115.0	115.0	115.0	0.7	0.0	0.0
116.0	116.0	116.0	0.7	0.0	0.0
117.0	117.0	117.0	0.7	0.0	0.0
118.0	118.0	118.0	0.7	0.0	0.0
119.0	119.0	119.0	0.7	0.0	0.0
120.0	120.0	120.0	0.7	0.0	0.0
121.0	121.0	121.0	0.7	0.0	0.0
89.0	89.0	89.0	0.7	0.0	0.0
84.0	84.0	84.0	0.7	0.0	0.0
79.0	79.0	79.0	0.7	0.0	0.0
74.0	74.0	74.0	0.7	0.0	0.0
69.0	69.0	69.0	0.7	0.0	0.0
64.0	64.0	64.0	0.7	0.0	0.0
59.0	59.0	59.0	0.7	0.0	0.0
54.0	54.0	54.0	0.7	0.0	0.0
49.0	49.0	49.0	0.7	0.0	0.0
44.0	44.0	44.0	0.7	0.0	0.0
39.0	38.9	38.9	0.7	-0.1	-0.1
34.0	33.9	33.9	0.7	-0.1	-0.1
29.0	28.9	28.9	0.7	-0.1	-0.1





Test Data for Sound Level Meter

Page 2 of 5

Sound level meter type: AWA5661 Serial No. 304718 Date 11-Apr-2021  
Microphone type: AWA14425 Serial No. 21038  
Report: 21CA0407 01-02

28.0	27.9	27.9	0.7	-0.1	-0.1
27.0	26.9	26.9	0.7	-0.1	-0.1
26.0	25.9	25.9	0.7	-0.1	-0.1

Measurements for an indication of the reference SPL on all other ranges which include it

Other ranges	Expected level	Actual level	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
26-121	94.0	94.0	0.7	0.0
46-141	94.0	94.0	0.7	0.0

Measurements on all level ranges for indications 2 dB below the upper limit and 2 dB above the lower limit

Ranges	Reference/Expected level	Actual level	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
26-121	28.0	27.9	0.7	-0.1
	119.0	119.0	0.7	0.0
46-141	48.0	48.1	0.7	0.1
	139.0	138.8	0.7	-0.2

## FREQUENCY WEIGHTING TEST

The frequency response of the weighting networks are tested at octave intervals over the frequency ranges 31.5 Hz to 12500 Hz. The signal level at 1000 Hz is set to give an indication of the reference SPL.

Frequency weighting A:

Frequency	Ref. level	Expected level	Actual level	Tolerance(dB)		Deviation
Hz	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	94.0	0.0	0.0	0.0
31.6	94.0	54.6	54.4	1.5	1.5	-0.2
63.1	94.0	67.8	67.7	1.5	1.5	-0.1
125.9	94.0	77.9	77.8	1.0	1.0	-0.1
251.2	94.0	85.4	85.3	1.0	1.0	-0.1
501.2	94.0	90.8	90.7	1.0	1.0	-0.1
1995.0	94.0	95.2	95.2	1.0	1.0	0.0
3981.0	94.0	95.0	95.2	1.0	1.0	0.2
7943.0	94.0	92.9	93.5	1.5	3.0	0.6
12590.0	94.0	89.7	89.3	3.0	6.0	-0.4

Frequency weighting C:

Frequency	Ref. level	Expected level	Actual level	Tolerance(dB)		Deviation
Hz	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	94.0	0.0	0.0	0.0
31.6	94.0	91.0	90.9	1.5	1.5	-0.1
63.1	94.0	93.2	93.1	1.5	1.5	-0.1
125.9	94.0	93.8	93.8	1.0	1.0	0.0



Test Data for Sound Level Meter

Page 3 of 5

Sound level meter type: AWA5661 Serial No. 304718 Date 11-Apr-2021  
Microphone type: AWA14425 Serial No. 21038  
Report: 21CA0407 01-02

251.2	94.0	94.0	94.0	1.0	1.0	0.0
501.2	94.0	94.0	94.0	1.0	1.0	0.0
1995.0	94.0	93.8	93.9	1.0	1.0	0.1
3981.0	94.0	93.2	93.5	1.0	1.0	0.3
7943.0	94.0	91.0	91.6	1.5	3.0	0.6
12590.0	94.0	87.8	87.4	3.0	6.0	-0.4

Frequency weighting Lin:

Frequency	Ref. level	Expected level	Actual level	Tolerance(dB)		Deviation
Hz	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	94.0	0.0	0.0	0.0
31.6	94.0	94.0	94.0	1.5	1.5	0.0
63.1	94.0	94.0	94.0	1.5	1.5	0.0
125.9	94.0	94.0	94.0	1.0	1.0	0.0
251.2	94.0	94.0	94.0	1.0	1.0	0.0
501.2	94.0	94.0	94.0	1.0	1.0	0.0
1995.0	94.0	94.0	94.0	1.0	1.0	0.0
3981.0	94.0	94.0	94.0	1.0	1.0	0.0
7943.0	94.0	94.0	94.0	1.5	3.0	0.0
12590.0	94.0	94.0	93.9	3.0	6.0	-0.1

TIME WEIGHTING FAST TEST

Time weighting F is tested on the reference range with a single sinusoidal burst of duration 200 ms at a frequency 2000 Hz and an amplitude which produces an indication 4 dB below the upper limit of the primary indicator range when the signal is continuous. (Weight A, Maximum hold)

Ref. level	Expected level	Actual level	Tolerance(dB)		Deviation
dB	dB	dB	+	-	dB
117.0	116.0	115.9	1.0	1.0	-0.1

TIME WEIGHTING SLOW TEST

Time weighting S is tested on the reference range with a single sinusoidal burst of duration 500 ms at a frequency 2000 Hz and an amplitude which produces an indication 4 dB below the upper limit of the primary indicator range when the signal is continuous. (Weight A, Maximum hold)

Ref. level	Expected level	Actual level	Tolerance(dB)		Deviation
dB	dB	dB	+	-	dB
117.0	112.9	112.9	1.0	1.0	0.0

PEAK RESPONSE TEST

The onset time of the peak detector is tested on the reference range by comparing the response to a 100 us rectangular test pulse with the response to a 10 ms reference pulse of the same amplitude. The amplitude of the 10 ms reference pulse is such as to produce an indication 1 dB below the upper limit of the primary indicator range. Positive polarities: (Weighting Z, set the generator signal to single, Lzpeak)

Ref. level	Response to 10 ms	Response to 100 us	Tolerance	Deviation
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Test Data for Sound Level Meter

Page 4 of 5

Sound level meter type: AWA5661 Serial No. 304718 Date 11-Apr-2021  
Microphone type: AWA14425 Serial No. 21038  
Report: 21CA0407 01-02

dB	dB	dB	+/- dB	dB
120.0	120.0	120.5	2.0	0.5

Negative polarities:

Ref. level	Response to 10 ms	Response to 100 us	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
120.0	120.0	120.5	2.0	0.5

RMS ACCURACY TEST

The RMS detector accuracy is tested on the reference range for a crest factor of 3.

Test frequency: 2000 Hz  
Amplitude: 2 dB below the upper limit of the primary indicator range.  
Burst repetition frequency: 40 Hz  
Tone burst signal: 11 cycles of a sine wave of frequency 2000 Hz. (Set to INT)

Time weighting	Ref. Level	Expected level	Tone burst signal	Tolerance	Deviation
	dB	dB	indication(dB)	+/- dB	dB
Slow	118.0+6.6	118.0	117.8	0.5	-0.2

TIME WEIGHTING IMPULSE TEST

Time weighting I is tested on the reference range (Set the SLM to LAImax)

Test frequency: 2000 Hz  
Amplitude: The upper limit of the primary indicator range.

Single sinusoidal burst of duration 5 ms:

Ref. Level	Single burst indication		Tolerance	Deviation
dB	Expected (dB)	Actual (dB)	+/- dB	dB
121.0	112.2	112.2	2.0	0.0

Repeated at 100 Hz

Ref. Level	Repeated burst indication		Tolerance	Deviation
dB	Expected (dB)	Actual (dB)	+/- dB	dB
121.0	118.3	118.1	1.0	-0.2

TIME AVERAGING TEST

This test compares the SLM reading for continuous sine signals with readings obtained from a sine tone burst sequence having the same RMS level. The test level is 30 dB below the upper limit of the linearity range and repeated for Type 1 SLM with 40 dB below the upper limit of the linearity.

Frequency of tone burst: 4000 Hz

Duration of tone burst: 1 ms

Repetition Time	Level of tone burst	Expected Leq	Actual Leq	Tolerance	Deviation	Remarks
msec	dB	dB	dB	+/- dB	dB	
1000	91.0	91.0	90.9	1.0	-0.1	60s integ.
10000	81.0	81.0	80.8	1.0	-0.2	6min. integ.

PULSE RANGE AND SOUND EXPOSURE LEVEL TEST

The test tone burst signal is superimposed on a baseline signal corresponding to the lower limit of reference range



Test Data for Sound Level Meter

Page 5 of 5

Sound level meter type: AWA5661 Serial No. 304718 Date 11-Apr-2021  
Microphone type: AWA14425 Serial No. 21038  
Report: 21CA0407 01-02

Test frequency: 4000 Hz

Integration time: 10 sec

The integrating sound level meter set to Leq:

Duration	Rms level of	Expected	Actual	Tolerance	Deviation
msec	tone burst (dB)	dB	dB	+/- dB	dB
10	91.0	61.0	60.8	1.7	-0.2

The integrating sound level meter set to SEL:

Duration	Rms level of	Expected	Actual	Tolerance	Deviation
msec	tone burst (dB)	dB	dB	+/- dB	dB
10.0	91.0	71.0	71.0	1.7	0.0

OVERLOAD INDICATION TEST

For SLM capable of operating in a non-integrating mode.

Test frequency: 2000 Hz  
Amplitude: 2 dB below the upper limit of the primary indicator range.  
Burst repetition frequency: 40 Hz  
Tone burst signal: 11 cycles of a sine wave of frequency 2000 Hz.

Level	Level reduced by	Further reduced	Difference	Tolerance	Deviation
at overload (dB)	1 dB	3 dB	dB	dB	dB
118.8	117.8	114.8	3.0	1.0	0.0

For integrating SLM, with the instrument indicating Leq.

For integrating SLM, with the instrument indicating Leq and set to the reference range. The test signal as following:

The test tone burst signal is superimposed on a baseline signal corresponding to the lower limit of reference range

Test frequency: 4000 Hz

Integration time: 10 sec

Single burst duration: 1 msec

Rms level	Level reduced by	Expected level	Actual level	Tolerance	Deviation
at overload (dB)	1 dB	dB	dB	dB	dB
125.7	124.7	84.7	84.5	2.2	-0.2

ACOUSTIC TEST

The acoustic test of the complete SLM is tested at the frequency 125 Hz and 8000 Hz using a B&K type 4226 Multifunction Acoustic Calibrator. The test is performed in A weighting.

Frequency	Expected level	Actual level	Tolerance (dB)		Deviation
Hz	dB	Measured (dB)	+	-	dB
1000	94.0	94.0	0.0	0.0	0.0
125	77.9	78.0	1.0	1.0	0.1
8000	92.9	93.1	1.5	3.0	0.2

-----END-----





綜合試驗有限公司

SOILS & MATERIALS ENGINEERING CO., LTD.

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## CERTIFICATE OF CALIBRATION

Certificate No.: 21CA0928 03-05

Page 1 of 2

### Item tested

Description:	Sound Level Meter (Class 1)	Microphone
Manufacturer:	Hangzhou Aihua Instruments Co., Ltd	-
Type/Model No.:	AWA5661	AWA14425
Serial/Equipment No.:	301135	15338
Adaptors used:	-	-

### Item submitted by

Customer Name:	Apex Testing & Certification Ltd.
Address of Customer:	Unit D6A, 10/F, TML Tower, 3 Hoi Shing Road, Tsuen Wan, N.T.
Request No.:	-
Date of receipt:	28-Sep-2021

Date of test: 04-Oct-2021

### Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Multi function sound calibrator	B&K 4226	2288444	23-Aug-2022	CIGISMEC
Signal generator	DS 360	61227	31-Dec-2021	CEPREI

### Ambient conditions

Temperature:	22 ± 1 °C
Relative humidity:	55 ± 10 %
Air pressure:	1005 ± 5 hPa

### Test specifications

- 1, The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 and the lab calibration procedure SMTP004-CA-152.
- 2, The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of ±20%.
- 3, The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responsess of the Sound Level Meter.

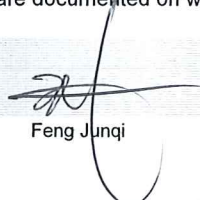
### Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

Actual Measurement data are documented on worksheets.

Approved Signatory:

  
Feng Junqi

Date: 06-Oct-2021

Company Chop:



**Comments:** The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument. The results apply to the item as received.

**CERTIFICATE OF CALIBRATION**

(Continuation Page)

Certificate No.: 21CA0928 03-05 Page 2 of 2

**1, Electrical Tests**

The electrical tests were performed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

Test:	Subtest:	Status:	Expanded Uncertainty (dB)	Coverage Factor
Self-generated noise	A	Pass	0.3	2.1
	C	Pass	0.8	
	Lin	Pass	1.6	
Linearity range for Leq	At reference range, Step 5 dB at 4 kHz	Pass	0.3	2.2
	Reference SPL on all other ranges	Pass	0.3	
	2 dB below upper limit of each range	Pass	0.3	
	2 dB above lower limit of each range	Pass	0.3	
	At reference range, Step 5 dB at 4 kHz	Pass	0.3	
Linearity range for SPL	A	Pass	0.3	
	C	Pass	0.3	
	Lin	Pass	0.3	
	Single Burst Fast	Pass	0.3	
Time weightings	Single Burst Slow	Pass	0.3	
	Single 100µs rectangular pulse	Pass	0.3	
Peak response	Crest factor of 3	Pass	0.3	
R.M.S. accuracy	Single burst 5 ms at 2000 Hz	Pass	0.3	
Time weighting I	Repeated at frequency of 100 Hz	Pass	0.3	
	1 ms burst duty factor 1/10 <sup>3</sup> at 4kHz	Pass	0.3	
Time averaging	1 ms burst duty factor 1/10 <sup>4</sup> at 4kHz	Pass	0.3	
	Single burst 10 ms at 4 kHz	Pass	0.4	
Pulse range	Single burst 10 ms at 4 kHz	Pass	0.4	
Sound exposure level	SPL	Pass	0.3	
Overload indication	Leq	Pass	0.4	

**2, Acoustic tests**

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

Test:	Subtest	Status	Expanded Uncertainty (dB)	Coverage Factor
Acoustic response	Weighting A at 125 Hz	Pass	0.3	
	Weighting A at 8000 Hz	Pass	0.5	

**3, Response to associated sound calibrator**

N/A

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

Calibrated by:

Fung Chi Yip

Date: 04-Oct-2021

Checked by:

Chan Yuk Yiu

Date: 06-Oct-2021

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.



Test Data for Sound Level Meter

Page 1 of 5

Sound level meter type: AWA5661  
Microphone type: AWA14425

Serial No. 301135  
Serial No. 15338

Date 04-Oct-2021

Report: 21CA0928 03-05

## SELF GENERATED NOISE TEST

The noise test is performed in the most sensitive range of the SLM with the microphone replaced by an equivalent impedance.

Noise level in A weighting	11.7	dB
Noise level in C weighting	12.5	dB
Noise level in Lin	16.7	dB

## LINEARITY TEST

The linearity is tested relative to the reference sound pressure level using a continuous sinusoidal signal of frequency 4 kHz. The measurement is made on the reference range for indications at 5 dB intervals starting from the 94 dB reference sound pressure level. And until within 5 dB of the upper and lower limits of the reference range, the measurements shall be made at 1 dB intervals. (SLM set to LEQ/SPL)

Reference/Expected level	Actual level		Tolerance	Deviation	
	non-integrated	integrated		non-integrated	integrated
dB	dB	dB	+/- dB	dB	dB
94.0	94.0	94.0	0.7	0.0	0.0
99.0	99.0	99.0	0.7	0.0	0.0
104.0	104.0	104.0	0.7	0.0	0.0
109.0	109.0	109.0	0.7	0.0	0.0
114.0	114.0	114.0	0.7	0.0	0.0
115.0	115.0	115.0	0.7	0.0	0.0
116.0	116.0	116.0	0.7	0.0	0.0
117.0	117.0	117.0	0.7	0.0	0.0
118.0	118.0	118.0	0.7	0.0	0.0
119.0	119.0	119.0	0.7	0.0	0.0
120.0	120.0	120.0	0.7	0.0	0.0
89.0	89.1	89.1	0.7	0.1	0.1
84.0	84.1	84.1	0.7	0.1	0.1
79.0	79.1	79.1	0.7	0.1	0.1
74.0	74.1	74.1	0.7	0.1	0.1
69.0	69.1	69.1	0.7	0.1	0.1
64.0	64.1	64.1	0.7	0.1	0.1
59.0	59.1	59.1	0.7	0.1	0.1
54.0	54.1	54.1	0.7	0.1	0.1
49.0	49.1	49.1	0.7	0.1	0.1
44.0	44.0	44.0	0.7	0.0	0.0
39.0	39.0	39.0	0.7	0.0	0.0
34.0	34.0	34.0	0.7	0.0	0.0
29.0	29.1	29.1	0.7	0.1	0.1
28.0	28.1	28.1	0.7	0.1	0.1





Test Data for Sound Level Meter

Page 2 of 5

Sound level meter type: AWA5661 Serial No. 301135 Date 04-Oct-2021  
Microphone type: AWA14425 Serial No. 15338  
Report: 21CA0928 03-05

27.0	27.1	27.1	0.7	0.1	0.1
26.0	26.2	26.2	0.7	0.2	0.2
25.0	25.3	25.3	0.7	0.3	0.3

Measurements for an indication of the reference SPL on all other ranges which include it

Other ranges	Expected level	Actual level	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
25-120	94.0	94.0	0.7	0.0
45-140	94.0	93.9	0.7	-0.1

Measurements on all level ranges for indications 2 dB below the upper limit and 2 dB above the lower limit

Ranges	Reference/Expected level	Actual level	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
25-120	27.0	27.1	0.7	0.1
	118.0	118.0	0.7	0.0
45-140	47.0	47.0	0.7	0.0
	138.0	137.7	0.7	-0.3

## FREQUENCY WEIGHTING TEST

The frequency response of the weighting networks are tested at octave intervals over the frequency ranges 31.5 Hz to 12500 Hz. The signal level at 1000 Hz is set to give an indication of the reference SPL.

Frequency weighting A:

Frequency	Ref. level	Expected level	Actual level	Tolerance(dB)		Deviation
Hz	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	94.0	0.0	0.0	0.0
31.6	94.0	54.6	54.3	1.5	1.5	-0.3
63.1	94.0	67.8	67.7	1.5	1.5	-0.1
125.9	94.0	77.9	77.8	1.0	1.0	-0.1
251.2	94.0	85.4	85.3	1.0	1.0	-0.1
501.2	94.0	90.8	90.7	1.0	1.0	-0.1
1995.0	94.0	95.2	95.2	1.0	1.0	0.0
3981.0	94.0	95.0	95.2	1.0	1.0	0.2
7943.0	94.0	92.9	93.5	1.5	3.0	0.6
12590.0	94.0	89.7	89.4	3.0	6.0	-0.3

Frequency weighting C:

Frequency	Ref. level	Expected level	Actual level	Tolerance(dB)		Deviation
Hz	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	94.0	0.0	0.0	0.0
31.6	94.0	91.0	90.8	1.5	1.5	-0.2
63.1	94.0	93.2	93.1	1.5	1.5	-0.1
125.9	94.0	93.8	93.8	1.0	1.0	0.0





Test Data for Sound Level Meter

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Sound level meter type: AWA5661 Serial No. 301135 Date 04-Oct-2021  
Microphone type: AWA14425 Serial No. 15338  
Report: 21CA0928 03-05

251.2	94.0	94.0	93.9	1.0	1.0	-0.1
501.2	94.0	94.0	94.0	1.0	1.0	0.0
1995.0	94.0	93.8	93.1	1.0	1.0	-0.7
3981.0	94.0	93.2	93.4	1.0	1.0	0.2
7943.0	94.0	91.0	91.6	1.5	3.0	0.6
12590.0	94.0	87.8	87.5	3.0	6.0	-0.3

Frequency weighting Lin:

Frequency	Ref. level	Expected level	Actual level	Tolerance(dB)		Deviation
Hz	dB	dB	dB	+	-	dB
1000.0	94.0	94.0	94.0	0.0	0.0	0.0
31.6	94.0	94.0	93.9	1.5	1.5	-0.1
63.1	94.0	94.0	94.0	1.5	1.5	0.0
125.9	94.0	94.0	94.0	1.0	1.0	0.0
251.2	94.0	94.0	94.0	1.0	1.0	0.0
501.2	94.0	94.0	94.0	1.0	1.0	0.0
1995.0	94.0	94.0	94.0	1.0	1.0	0.0
3981.0	94.0	94.0	94.0	1.0	1.0	0.0
7943.0	94.0	94.0	94.0	1.5	3.0	0.0
12590.0	94.0	94.0	93.9	3.0	6.0	-0.1

TIME WEIGHTING FAST TEST

Time weighting F is tested on the reference range with a single sinusoidal burst of duration 200 ms at a frequency 2000 Hz and an amplitude which produces an indication 4 dB below the upper limit of the primary indicator range when the signal is continuous. (Weight A, Maximum hold)

Ref. level	Expected level	Actual level	Tolerance(dB)		Deviation
dB	dB	dB	+	-	dB
116.0	115.0	115.0	1.0	1.0	0.0

TIME WEIGHTING SLOW TEST

Time weighting S is tested on the reference range with a single sinusoidal burst of duration 500 ms at a frequency 2000 Hz and an amplitude which produces an indication 4 dB below the upper limit of the primary indicator range when the signal is continuous. (Weight A, Maximum hold)

Ref. level	Expected level	Actual level	Tolerance(dB)		Deviation
dB	dB	dB	+	-	dB
116.0	111.9	111.9	1.0	1.0	0.0

PEAK RESPONSE TEST

The onset time of the peak detector is tested on the reference range by comparing the response to a 100 us rectangular test pulse with the response to a 10 ms reference pulse of the same amplitude. The amplitude of the 10 ms reference pulse is such as to produce an indication 1 dB below the upper limit of the primary indicator range.

Positive polarities: (Weighting Z, set the generator signal to single, Lzpeak)

Ref. level	Response to 10 ms	Response to 100 us	Tolerance	Deviation
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Test Data for Sound Level Meter

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Sound level meter type: AWA5661 Serial No. 301135 Date 04-Oct-2021  
Microphone type: AWA14425 Serial No. 15338  
Report: 21CA0928 03-05

dB	dB	dB	+/- dB	dB
119.0	119.0	119.3	2.0	0.3

Negative polarities:

Ref. level	Response to 10 ms	Response to 100 us	Tolerance	Deviation
dB	dB	dB	+/- dB	dB
119.0	119.0	119.3	2.0	0.3

RMS ACCURACY TEST

The RMS detector accuracy is tested on the reference range for a crest factor of 3.

Test frequency: 2000 Hz  
Amplitude: 2 dB below the upper limit of the primary indicator range.  
Burst repetition frequency: 40 Hz  
Tone burst signal: 11 cycles of a sine wave of frequency 2000 Hz. (Set to INT)

	Ref. Level	Expected level	Tone burst signal	Tolerance	Deviation
Time weighting	dB	dB	indication(dB)	+/- dB	dB
Slow	116.0+6.6	116.0	115.8	0.5	-0.2

TIME WEIGHTING IMPULSE TEST

Time weighting I is tested on the reference range (Set the SLM to LAImax)

Test frequency: 2000 Hz  
Amplitude: The upper limit of the primary indicator range.

Single sinusoidal burst of duration 5 ms:

Ref. Level	Single burst indication		Tolerance	Deviation
dB	Expected (dB)	Actual (dB)	+/- dB	dB
120.0	111.2	111.1	2.0	-0.1

Repeated at 100 Hz

Ref. Level	Repeated burst indication		Tolerance	Deviation
dB	Expected (dB)	Actual (dB)	+/- dB	dB
120.0	117.3	117.1	1.0	-0.2

TIME AVERAGING TEST

This test compares the SLM reading for continuous sine signals with readings obtained from a sine tone burst sequence having the same RMS level. The test level is 30 dB below the upper limit of the linearity range and repeated for Type 1 SLM with 40 dB below the upper limit of the linearity.

Frequency of tone burst: 4000 Hz

Duration of tone burst: 1 ms

Repetition Time	Level of tone burst	Expected Leq	Actual Leq	Tolerance	Deviation	Remarks
msec	dB	dB	dB	+/- dB	dB	
1000	90.0	90.0	89.8	1.0	-0.2	60s integ.
10000	80.0	80.0	79.8	1.0	-0.2	6min. integ.

PULSE RANGE AND SOUND EXPOSURE LEVEL TEST

The test tone burst signal is superimposed on a baseline signal corresponding to the lower limit of reference range





Test Data for Sound Level Meter

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Sound level meter type: AWA5661 Serial No. 301135 Date 04-Oct-2021  
Microphone type: AWA14425 Serial No. 15338

Report: 21CA0928 03-05

Test frequency: 4000 Hz

Integration time: 10 sec

The integrating sound level meter set to Leq:

Duration	Rms level of	Expected	Actual	Tolerance	Deviation
msec	tone burst (dB)	dB	dB	+/- dB	dB
10	90.0	60.0	59.8	1.7	-0.2

The integrating sound level meter set to SEL:

Duration	Rms level of	Expected	Actual	Tolerance	Deviation
msec	tone burst (dB)	dB	dB	+/- dB	dB
10.0	90.0	70.0	70.0	1.7	0.0

OVERLOAD INDICATION TEST

For SLM capable of operating in a non-integrating mode.

Test frequency: 2000 Hz  
Amplitude: 2 dB below the upper limit of the primary indicator range.  
Burst repetition frequency: 40 Hz  
Tone burst signal: 11 cycles of a sine wave of frequency 2000 Hz.

Level	Level reduced by	Further reduced	Difference	Tolerance	Deviation
at overload (dB)	1 dB	3 dB	dB	dB	dB
115.6	114.6	111.6	3.0	1.0	0.0

For integrating SLM, with the instrument indicating Leq.

For integrating SLM, with the instrument indicating Leq and set to the reference range. The test signal as following:

The test tone burst signal is superimposed on a baseline signal corresponding to the lower limit of reference range

Test frequency: 4000 Hz

Integration time: 10 sec

Single burst duration: 1 msec

Rms level	Level reduced by	Expected level	Actual level	Tolerance	Deviation
at overload (dB)	1 dB	dB	dB	dB	dB
121.9	120.9	80.9	80.7	2.2	-0.2

ACOUSTIC TEST

The acoustic test of the complete SLM is tested at the frequency 125 Hz and 8000 Hz using a B&K type 4226 Multifunction Acoustic Calibrator. The test is performed in A weighting.

Frequency	Expected level	Actual level	Tolerance (dB)		Deviation
Hz	dB	Measured (dB)	+	-	dB
1000	94.0	94.0	0.0	0.0	0.0
125	77.9	78.2	1.0	1.0	0.3
8000	92.9	93.6	1.5	3.0	0.7

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## CERTIFICATE OF CALIBRATION

Certificate No.: 21CA0616 01-02

Page: 1 of 2

### Item tested

Description: Acoustical Calibrator (Class 1)  
Manufacturer: Pulsar  
Type/Model No.: 100B  
Serial/Equipment No.: 039507  
Adaptors used: Yes

### Item submitted by

Customer: Apex Testing & Certification Ltd.  
Address of Customer: Unit D6A, 10/F, TML Tower, 3 Hoi Shing Road, Tsuen Wan, N.T.  
Request No.: -  
Date of receipt: 16-Jun-2021

Date of test: 18-Jun-2021

### Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Lab standard microphone	B&K 4180	2341427	04-May-2022	SCL
Preamplifier	B&K 2673	2239857	31-May-2022	CEPREI
Measuring amplifier	B&K 2610	2346941	01-Jun-2022	CEPREI
Signal generator	DS 360	33873	27-May-2022	CEPREI
Digital multi-meter	34401A	US36087050	27-May-2022	CEPREI
Audio analyzer	8903B	GB41300350	28-May-2022	CEPREI
Universal counter	53132A	MY40003662	02-Jun-2022	CEPREI

### Ambient conditions

Temperature:  $22 \pm 1^\circ\text{C}$   
Relative humidity:  $55 \pm 10\%$   
Air pressure:  $1010 \pm 5\text{ hPa}$

### Test specifications

- The Sound Calibrator has been calibrated in accordance with the requirements as specified in IEC 60942 1997 Annex B and the lab calibration procedure SMTP004-CA-156.
- The calibrator was tested with its axis vertical facing downwards at the specific frequency using insert voltage technique.
- The results are rounded to the nearest 0.01 dB and 0.1 Hz and have not been corrected for variations from a reference pressure of 1013.25 hectoPascals as the maker's information indicates that the instrument is insensitive to pressure changes.

### Test results

This is to certify that the sound calibrator conforms to the requirements of annex B of IEC 60942: 1997 for the conditions under which the test was performed. This does not imply that the sound calibrator meets IEC 60942 under any other conditions.

Details of the performed measurements are presented on page 2 of this certificate.

Approved Signatory:

  
Feng Junqi

Date: 19-Jun-2021

Company Chop:



Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument. The results apply to the item as received.

**CERTIFICATE OF CALIBRATION**

(Continuation Page)

Certificate No.:

21CA0616 01-02

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**1, Measured Sound Pressure Level**

The output Sound Pressure Level in the calibrator head was measured at the setting and frequency shown using a calibrated laboratory standard microphone and insert voltage technique. The results are given in below with the estimated uncertainties.

(Output level in dB re 20  $\mu$ Pa)

Frequency Shown Hz	Output Sound Pressure Level Setting dB	Measured Output Sound Pressure Level dB	Estimated Expanded Uncertainty dB
1000	94.00	94.15	0.10

**2, Sound Pressure Level Stability - Short Term Fluctuations**

The Short Term Fluctuations was determined by measuring the maximum and minimum of the fast weighted DC output of the B&K 2610 measuring amplifier over a 20 second time interval as required in the standard. The Short Term Fluctuation was found to be:

At 1000 Hz

STF = 0.019 dB

Estimated expanded uncertainty

0.005 dB

**3, Actual Output Frequency**

The determination of actual output frequency was made using a B&K 4180 microphone together with a B&K 2673 preamplifier connected to a B&K 2610 measuring amplifier. The AC output of the B&K 2610 was taken to an universal counter which was used to determine the frequency averaged over 20 second of operation as required by the standard. The actual output frequency at 1 KHz was:

At 1000 Hz

Actual Frequency = 999.86 Hz

Estimated expanded uncertainty

0.1 Hz

Coverage factor k = 2.2

**4, Total Noise and Distortion**

For the Total Noise and Distortion measurement, the unfiltered AC output of the B&K 2610 measuring amplifier was connected to an Agilent Type 8903 B distortion analyser. The TND result at 1 KHz was:

At 1000 Hz

TND = 0.9 %

Estimated expanded uncertainty

0.7 %

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

Calibrated by:

Date:

Fung Chi Yip  
18-Jun-2021

- End -

Checked by:

Date:

Chan Yuk Yiu  
19-Jun-2021

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.